

NEW RECORDS OF GRAPHIDACEOUS LICHENS FROM WESTERN GHATS, INDIA

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ABSTRACT: Six lichen species belonging to the family Graphidaceae namely *Graphis malacodes* Nyl., *Graphis proserpens* Vain., *Hemithecium aphanemicrosporium* Makhija & Adawadkar, *Hemithecium lamii* (Redgr.) V. Tewari & Upreti, *Pallidogramme chlorocarpoides* (Nyl.) Staiger & al. and *Phaeographis divaricoides* Räsänen are described as new additions to the lichen flora of Western Ghats. Chemical studies were carried out by thin layer chromatography using Merk F254 precoated silica gel aluminium plates and B.D.A. solvent systems.

INTRODUCTION

There are about 13,500 lichen species inhabiting the earth. They extend from the tropics to the Polar Regions in a variety of habitats such as tree barks, leaves, bare rock surfaces, cooled lava flows, desert sands and tundra soils. The lichens are common to abundant in temperate and alpine regions of the Himalayas and hilly regions of Peninsular India. The lichen family Graphidaceae comprises of more than 1,500 species throughout the world (Tewari and Upreti, 2007). It is one of the largest and widely distributed groups in the lichen flora of India and so far known by about 200 species from Indian subcontinent of which 103 species have been reported from Western Ghats and about 45 are known from Kerala. It is distinguished by an ecorticate thallus, lirellate apothecia and colourless or brown, septate to muriform ascospores. An important feature in separating species and genera of Graphidaceae has traditionally been ascospore characteristics, i.e. septum and colour (Muller, 1880). Only a limited number of species form four celled, colourless ascospores. Genera belonging to the Graphidaceae were well defined by Staiger (2002) who stressed the value of ascospores and their accessory organs rather than spore morphology (Nakanishi, 1966; Wirth and Hale, 1978) for generic delimitation. The occurrence of isidia and soredia is rather rare in the

family. Awasthi (2000) listed 215 taxa of the family Graphidaceae from Indian subcontinent.

MATERIALS AND METHODS

In our on-going research project on Lichens of Western Ghats of Kerala, over 150 specimens of the family Graphidaceae were collected during the last four years from different forest localities. Specimens collected from Trivandrum, Kollam, Ernakulam, Palghat and Wayanad districts of Kerala state were studied. All the specimens were examined under dissection microscope. Sections of thalli and lirellae were mounted in water and lacto phenol cotton-blue solution for anatomical studies. All the measurements were made in water. TLC was carried out using the standard methods (White and James, 1985) with solvent system benzene-dioxane-acetic acid (180:45:5). All the studied specimens were deposited at the regional herbarium of Jawaharlal Nehru Tropical Botanic Garden and Research Institute under TBGT.

GRAPHIS Adans., Fam. Pl. 2: 11. 1763.

Thallus crustose, usually epi - or endophloedal, rarely saxicolous or foliicolous. Photobiont a green alga (*Trentepohlia*). Apothecia lirellate, usually elongate, simple or variously branched, rarely short oryzaeform, immersed in the thallus or emergent, sessile, margin connivent or not, exciple complete

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(closed) or dimidiate (deficient at base), totally or partially black, brown, yellow or colourless, labia of exciple entire or crenate-sulcate, hypothecium thin. Paraphyses simple, not thickened at apices. Asci clavate to subcylindrical, (1-) 2-4-8-spored, spores colourless, transversely 3-many septate, oblong-ellipsoid to fusiform, locules lentiform.

1. *Graphis malacodes* Nyl. Bull. Soc. Linn. Normandie, ser. 2, 2: 116. 1868.

Phaeographis malacodes (Nyl.) Zahlbr., Cat. Lich. Univ. 2: 381. 1924.

Specimens examined: Pandupara, Kaladi Range, Ernakulam, Kerala, alt. 150 m, December 20, 2006, H. Biju, LWG 06-008404, TBGT 1495.

Chemistry: Thallus K+ red, P-; TLC: No lichen substance present.

Ecological Notes: Rare. The species occurs at an altitude of 150 m in the evergreen forest margins. The associated species in the community includes crustose lichens *viz.*, *Chiodecton leptosporum* Müll. Arg., *Hemithecium lamii* (Redgr.) V. Tewari & Upreti and *Porina subcutanea* Ach., and a foliose lichen - *Leptogium denticulatum* Nyl.

Remarks: *Graphis malacodes* is close to *G. intermediella* Stirt. but differs from it in the presence of irregularly branched ascomata.

Distribution: Outside India, the taxon is reported from AUSTRALIA (QUEENSLAND) and NEW Caledonia. In INDIA, it is reported only from Assam and is a new record to Western Ghats.

2. *Graphis proserpens* Vain. Bot. Tidsskr. 29(2): 132. 1909.

Graphis disserpens Vain. Zahlbruckner's Cat. Lich. Univ. 2: 404. 1890.

Specimens examined: Rosemala, Kollam, Kerala, June 27, 2006, H. Biju, LWG 06-008213, TBGT 809.

Chemistry: Thallus K-, C-, KC-, P-; TLC: No lichen substance present.

Ecological Notes: Rare. Grows on semi-evergreen forest floor. The species is associated with crustose lichens *viz.* *Cryptothecia lumulata* (Zahlbr.) Makhija & Patw., *C. subsecta* Stirt., *Graphis proserpens* Vainio., *Myriotrema clandestinum* (Fée) Hale, *Ocellularia albomaculata* Hale, *Porina tetracerae* (Afz.) Müll. Arg., *Reimnitzia santensis* (Tuck.) Kalb, *Thelotrema kamatii* (Patw. & C.R. Kulk.) Hale, and *Topeliopsis pseudoexanthismocarpa* (Mont. & Bosch) Mangold, and foliose lichens - *Parmotrema dilatatum* (Vain.) Hale, *Heterodermia isidiophora* (Vain.) Awas., and *Leptogium phyllocarpum* (Pers.) Mont.

Remarks: *Graphis proserpens* is close to *G. sikkimensis* Nag. & Patw. but in latter, mature lirellae are dichotomously branched, distinctly tapering, shiny, black, much longer in size and K+ thallus (Tewari, 2007).

Distribution: Outside India, it is reported from BRAZIL, CHINA, COSTA RICA, INDONESIA, JAPAN, PHILIPPINES and THAILAND (Tewari, 2007). In INDIA, the taxon is distributed in Madhya Pradesh, Meghalaya, Nagaland, Sikkim, Uttarakhand and West Bengal and is a new record to Western Ghats.

HEMITHECIUM Trevis., Spighe e Pagile 1: 12. 1853.

Thallus crustose, apothecia lirellate, exciple uncarbonised, I+ brown to reddish brown, spores brown or hyaline, labia well developed, convergent, distinctly crenate, with internal stripe. Paraphyses tips smooth, not warty.

3. *Hemithecium aphaneomicrosporum* Makhija & Adawadkar, Mycotaxon 91: 348. 2005.

Specimens examined: Kaladi range, Ernakulam, Kerala, alt. 150 m, December 20, 2006, H. Biju, LWG 06-008405, TBGT 1488.

Chemistry: Thallus K+ red, P-; TLC: Constictic and Stictic acid present.

Ecological Notes: Rare. The species occurs at an altitude of 150 m in the evergreen forest margins. The species found with crustose lichens *viz.* *Chiodecton leptosporum* Müll. Arg., *Cryptothecia dissimilis* Makhija & Patw., *Hemithecium*

aphaneomicrosporum Makhija & Adawadkar, *Pycnora sorophora* (Vain.) Hafellner and foliose lichens - *Leptogium denticulatum* Nyl., *Phyllopsora parvifolia* (Pers.) Müll. Arg. and *P. corallina* (Eschw.) Müll. Arg.

Remarks: *Hemithecium aphanomicrosporum* is very similar to *H. aphanes* (Mont. & Bosch) M. Nakan & Kashiw., a species from Java from which it differs in having much smaller ascospores. *H. aphanes* has ascospores of 80-100 µm long (Makhija and Adawadkar, 2005).

Distribution: The species is known only from its type locality in Andaman Island (Makhija and Adawadkar, 2005) and is reported here for the first time from Western Ghats.

4. *Hemithecium lamii* (Redgr.) V. Tewari & Upreti, *Phytotaxonomy* 7: 24, 2007.

Phaeographina lamii Redgr., *Rev. Bryol. et Lichenol.* 9: 102. 1936.

Specimens examined: On the way to Pongalappara, ABP, Trivandrum, alt. 1145 m, April 26, 2006, H. Biju, LWG 06-008399, TBGT 537; Kuruva Islands, Wayanad, alt. 720 m, May 19, 2006, H. Biju, LWG 06-008400, TBGT 1206; Parambikulam WLS, Palghat, alt. 900 m, November 14, 2006, H. Biju, LWG 06-008403, TBGT 1403; Pandupara, Kaladi range, Ernakulam, Kerala, alt. 150 m, December 20, 2006, H. Biju, LWG 06-008402, TBGT 1500.

Chemistry: Thallus K+ red, P-; TLC: Stictic and constictic acids present.

Ecological Notes: Frequent. Distributed in tropical deciduous and semi evergreen forests and sometimes in grasslands at altitudes between 150-1145 m. This species found associated with crustose lichens viz. *Chiodecton leptosporum* Müll. Arg., *Cratiria obscurior* (Stirt.), *Cryptothecia subsecta* Stirt., *Graphis malacodes* Nyl., *Hemithecium lamii* (Redgr.) Tewari & Upreti, *Pallidogramme chlorocarpoides* (Nyl.) Staiger, *Pertusaria leucosorodes* Nyl., *Porina subcutanea* Ach., *Pycnora sorophora* (Vain.) Hafellner, and *Thecaria quassiicola* Fée and foliose lichens - *Coccocarpia pellita* (Ach.) Müll. Arg. em. R. Sant, *Heterodermia boryi* (Fée) Kr. P. Singh & S.R.

Singh, *H. togashii* (Kurok.) Awas., *Hypotrachyna rhabdiformis* (Kurok.) Hale, *Leptogium chloromelum* (Sw.) Nyl., *Myelochroa aurulenta* (Tuck.) Elix & Hale, *Parmotrema cristiferum* (Taylor) Hale, *P. tinctorum* (Nyl.) Hale, *Phyllopsora buettneri* (Müll. Arg.) Zahlbr., *Pyxine petricola* Nyl., *Sticta weigelii* (Ach.) Vain., and *Teloschistes flavicans* (Swartz) Norm., and fruticose lichens - *Ramalina conduplicans* Vain., *R. nervulosa* (Müll. Arg.) Abbayes and *Roccella montagnei* Bél.

Remarks: The taxon is characterised by woody sulcate exciple, cordate shaped hymenium and 1-2 spored asci (Tewari, 2007). It is close to *H. chrysenteron* (Mont.) Trevis. but differs from it in the presence of closed exciple and single to 2 spored asci.

Distribution: Outside India, the taxon is reported from INDONESIA. In India, it is reported from Andaman & Nicobar Islands, Arunachal Pradesh and West Bengal (Singh and Sinha, 2010) and forms a new record to Western Ghats.

PALLIDOGRAMME Staiger & al. in Lükling & al., *Fieldiana, Bot.* 46: 9. 2008.

Thallus crustose, apothecia lirellate, exciple uncarbonised, I+ brown to reddish brown, spores brown or hyaline, labia well developed, convergent, distinctly crenate, with internal stripe. Paraphyses tips smooth, not warty.

5. *Pallidogramme chlorocarpoides* (Nyl.) Staiger & al. in Lükling & al., *Fieldiana Bot.* 46: 9. 2008.

Graphis chlorocarpoides Nyl., *Flora* 49: 133. 1866.

Phaeographina chlorocarpoides (Nyl.) Zahlbr., *Cat. Lich. Univ.* 2: 435. 1923.

Hemithecium chlorocarpoides (Nyl.) Staiger, *Biblioth. Lichenol.* 85: 283. 2002.

Specimens examined: Kuruva Islands, Wayanad, alt. 720 m, May 19, 2006, H. Biju, LWG 06-007994, TBGT 776; Braemore, Trivandrum, alt. 520 m, November 9, 2006, H. Biju, LWG 06-008322, TBGT 1337; Thattekkad Bird Sanctuary, Ernakulam, Kerala, alt. 380 m, December 21, 2006, H. Biju, LWG 06-007995, TBGT 1533.

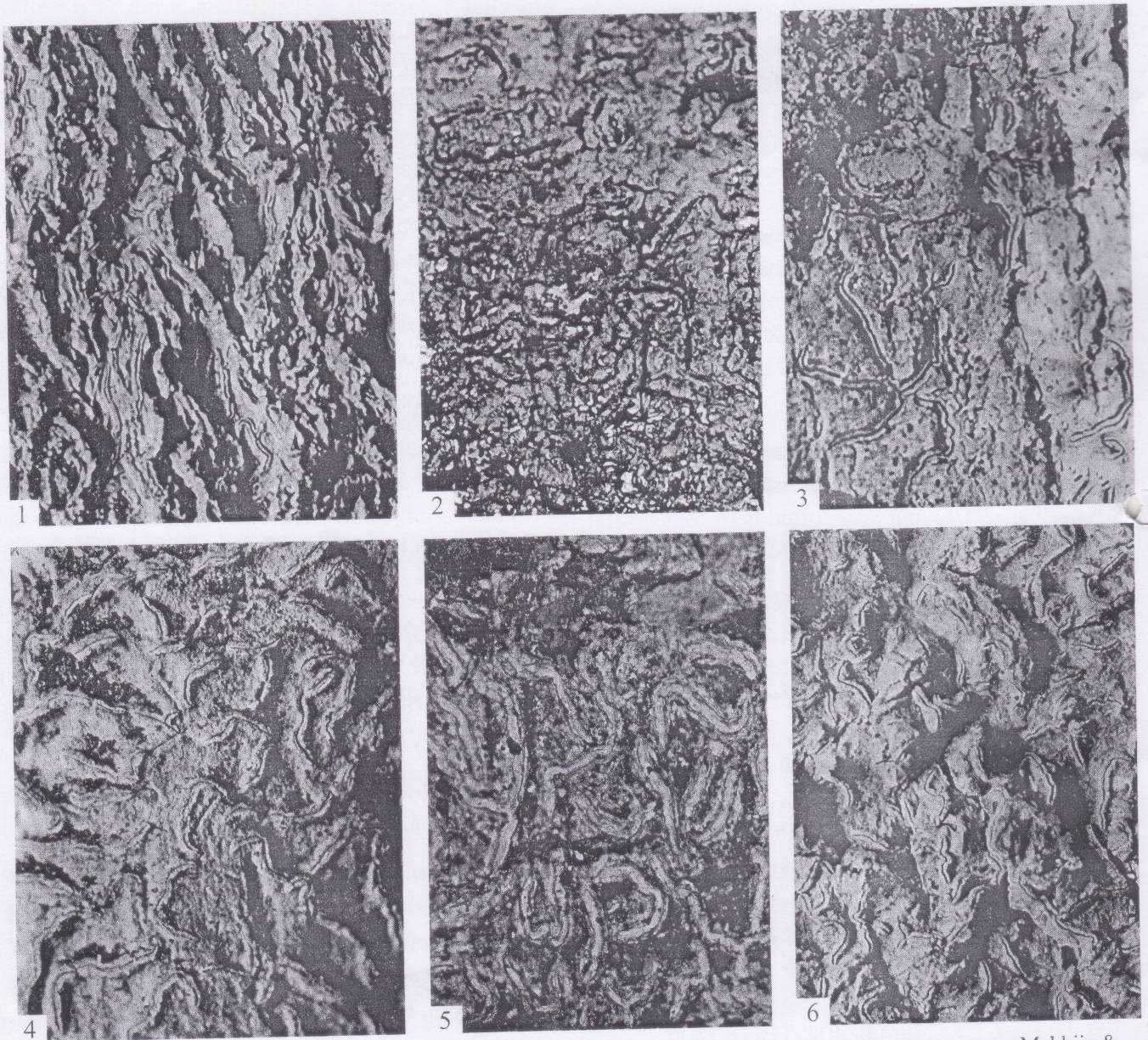


Fig. 1. *Graphis malacodes* Nyl. **Fig. 2.** *Graphis proserpens* Vain. **Fig. 3.** *Hemithecium aphanemicrosporium* Makhija & Adawadkar; **Fig. 4.** *Hemithecium lamii* (Redgr.) Tewari & Upreti; **Fig. 5.** *Pallidogramme chlorocarpoides* (Nyl.) Staiger & al.; **Fig. 6.** *Phaeographis divaricoides* Räsänen

Chemistry: Thallus K⁺ red, P⁻; TLC: No lichen substances present.

Ecological Notes: Generally found in evergreen forests with an altitude of 380-720 m. Associated species includes crustose lichens *viz* *Bacidia medialis* (Tuck.) Zahlbr., *Cryptothecia dissimilis* Makhija & Patw., *Graphis subserpentina* Nyl., *Hemithecium aphanes* (Mont. & Bosch) M. Nakan & Kashiw., *Myriotrema trypaneoides* (Nyl.) Hale, *Ocellularia ascidioidea* Hale, *Pallidogramme chlorocarpoides*

(Nyl.) Staiger, *Pertusaria leucosorodes* Nyl., *Phaeographis divaricoides* Räsänen, *Platygramme wattiana* (Müll. Arg.) V. Tewari & Upreti, *Porina rhodostoma* Müll. Arg., *Pycnora sorophora* (Vain.) Hafellner, and *Thelotrema kamatii* (Patw. & C.R. Kulk.) Hale and foliose lichens - *Bulbothrix tabacina* (Mont. & Bosch) Hale, *Coccocarpia palmicola* (Sprengel) Arvid & D.J. Galloway, *Heterodermia diademata* (Taylor) Awas., *H. speciosa* (Wulfen) Trevisan, *Leptogium denticulatum* Nyl., *Parmotrema cristiferum* (Taylor) Hale, *P. praesorediosum* (Nyl.)

Hale, *Phyllopsora corallina* (Eschw.) Müll. Arg., and *Pyxine austroindica* Awas.

Remarks: The taxon shows similarity with *Pallidogramme chrysenderon* (Mont.) Staiger, Kalb. & Lücking, but latter differs in having 8-spored asci, smaller ascospores and presence of stictic acid complex in thallus (Tewari, 2007).

Distribution: Outside India, it is reported from AUSTRALIA, INDONESIA, PHILIPPINES and SRI LANKA. In INDIA, the taxon is reported from Assam, Meghalaya, Sikkim and West Bengal (Singh and Sinha, 2010) and the present collections form a new record to Western Ghats.

APHAEOGRAPHIS Müll. Arg. Flora 65: 336, 1882

Thallus crustose, effuse, epi- or endo-phloedal, rarely epilithic. Photobiont a green alga (*Trentepohlia*). Apothecia rarely oblong, generally elongate-lirellate, simple or branched, emergent or immersed, exciple closed or open, black, brown, yellowish or colourless. Paraphyses simple. Asci usually 8-spored, spores brown, transversely 3-15-septate.

6. *Phaeographis divaricoides* Räsänen, Arch. Soc. Zool. Bot. Fenn. Vanamo 5: 31. 1950.

Specimens examined: Thattakkad Bird Sanctuary, Ernakulam, Kerala, alt. 360 m, December 21, 2006, H. Biju, LWG 06-008411, TBGT 1550.

Chemistry: Thallus K+ red, P-; TLC: No lichen substances present.

Ecological Notes: Occurs at an altitude of 360m in the evergreen forest areas. It is associated with some crustose lichens viz. *Bacidia medialis* (Tuck.) Zahlbr., *Cryptothecia dissimilis* Makhija & Patw., *Hemithecium aphanes* (Mont. & Bosch) M. Nakan & Kashiw., *Myriotrema trypaneoides* (Nyl.) Hale, *Ocellularia ascidioidea* Hale, *Pallidogramme chlorocarpoides* (Nyl.) Staiger, *Phaeographis divaricoides* Räsänen, *Porina rhodostoma* Müll. Arg., and *Thelotrema kamatii* (Patw. & C.R. Kulk.) Hale and few foliose lichens - *Bulbothrix tabacina* (Mont. & Bosch) Hale, *Coccocarpia palmicola* (Sprengel) Arvid & D.J. Galloway, *Leptogium denticulatum* Nyl., *Phyllopsora corallina* (Eschw.) Müll. Arg., and *Pyxine austroindica* Awas..

Remarks: The taxon is characterised by divaricately branched, 5-15 mm long lirellae, naked labial

apices, 8-spored asci and transversely 6-8 locular spores (Tewari, 2007). It is close to *Phaeographina chlorocarpoides* (Nyl.) Zahlbr. but differs from it in the presence of transversely septate spores and simple to divaricately branched lirellae.

Distribution: The taxon is endemic to India and reported from Nagaland, Eastern regions of Sikkim and West Bengal (Tewari, 2007) and the present collection forms a new record to Western Ghats.

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Book Review

Forest Conservation Concerns in India

S. Shyam Sunder and S. Parameswarappa

Shyam Sunder S. and Parameswarappa S. are two foresters, who between them administered, for about 15 years, over four million hectares of forests, including in the Western Ghats of India. In this volume they trace the critical junctures of forest conservation and management in India, of the battle between practical conservation and arm chair environmentalists, and describe in detail the changing condition of forests from around 1850 onwards. Marshaling evidence from a variety of sources, they take aim at the simple-minded world view of some prominent academics, laying bare the factual inaccuracies and misrepresentations in the management of Indian forests.

Several chapters focus on the pre-colonial period and highlight a central argument that clearing forests for pastures and agriculture has been a driving force behind expansion of all indigenous human civilizations in India. Subsequently, they trace the history of the intellectual ideas about forest conservation, with examples from within and outside of India, and link them with the needs of forest conservation in the early colonial period. In subsequent chapters they critically analyze post-independence social policies that promoted large scale diversion of natural forests for cultivation, and which led to the destruction of vast areas of wooded commons.

In subsequent chapters they take on academic critics of Indian forestry, of deliberately ignoring evidence, lacking in technical knowledge, and promoting a simplified world view of 'good versus evil' in forest control and management. They buttress their devastating criticism of many issues propagated by some of the leading Indian academic environmentalists, including on forest reservation, the planting of exotics, shifting cultivation, and forest 'conservation' movement.

This book makes an immense contribution to our collective understanding of the complexities of managing forest commons, of the role of the state and civil society stakeholders and of the implications of ideology driven forest policies. This volume is invaluable not only to officials and environmental activists in India and in the tropical world who are grappling with the practice of forest and ecosystem management, but also in helping advance just and sustainable policies on local livelihoods, biodiversity and ecosystem resilience. The volume is of immense importance also to students of environmental history, and political economy of natural resource management.

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